Effects of causal loop diagrams on escalating commitment

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Abstract

Previous research suggests that decision makers have the tendency to keep on investing in losing courses of action. The present study focuses on de-escalation and proposes causal loop diagrams as a technique to decrease escalating commitment in a failing action. The effectiveness of causal loop diagrams is also contrasted with the effect of receiving a list of important factors. Causal loop diagrams were found to decrease commitment as compared to having no decision aid. However, no significant difference was found between causal loop diagrams and a list of important factors as a de-escalation technique.

Keywords: causal loop diagram, escalation of commitment, de-escalation, experiment

Introduction

Continued commitment to a losing course of action has been the focus of research in organizational behavior and psychology since the late 1970s under different headings such as entrapment (Brockner and Rubin, 1985), sunk cost effect (Arkes and Blumer, 1985; Garland), too much invested to quit (Tegar, 1980), and escalation of commitment (Staw, 1976, 1981). The phenomenon, most commonly referred to as escalation of commitment, is the tendency to keep on investing in a failing course of action (ref). Decision-makers keep on committing further resources to a previously chosen course of action even in the face of negative performance feedback (Staw 1976). Escalation situations are those “where losses have been suffered, where there is an opportunity to persist or withdraw, and where the consequences of these actions are uncertain” (Staw). Hence, neither withdrawal nor persistence is a clear-cut solution to the problem of the decision-maker.

Empirical research investigating escalation of commitment has mainly been experimental. However, recently there have also been some case studies showing the robustness of experimental findings in different application areas such as information systems development (Keil, 1995), new product development (Boulding et. al., 1997), NBA (Staw, 1995). Much of the past research focused on the determinant of escalation leading to a long list of factors (Staw and Ross, 1987). Even though the different causes of escalating commitment are well understood, strategies for how people can avoid escalation did not receive much attention in research. This is a pity because understanding how de-escalation can be achieved can lead to policy recommendations (Simonson and Staw, 1992).

In this paper, we are proposing system dynamics modeling as a technique for de-escalation. We hypothesize that analyzing a system dynamics model of the problem situation will lead to de-escalation. First, we will summarize the past research on de-escalation. Hypotheses on the role of system dynamics in reducing escalating commitment will be presented. Next, the experimental design and the results will be described. In the conclusions, the implications of the results will be discussed.

Past research on De-escalation commitment

De-escalation of commitment occurs when there is "reduced commitment to a failing course of action" (Montealegre and Keil, 2000). Past research generated a list of possible factors affecting de-escalation (Keil and Robey, 1995; Montealegre and Keil, 2000). These factors can be divided into three groups: situational factors, objective information on the project and its progress, and specific techniques or procedures.

It has been shown that situational factors such as change in top management support or project leader, external pressures on the organization, stakeholder interest, organizational tolerance for failure lead to de-escalation. Early research also showed that highlighting certain objective information on the project lead to de-escalation. For instance, providing decision-makers with alternative strategies (McCain, 1986, Northcraft and Neale, 1986), highlighting endogenous causes of failure (Staw and Ross, 1978), repeated failure feedback (Staw and Fox, 1977, McCain, 1986, Garland et. al. 1990), setting explicit goals (Kernan and Lord, 1989), visibility of project costs (Brockner et. al., 1979), information on high efficacy of resources (Staw and Fox 1977, Bateman 1986) decreases investments.

Even though some situational factors have been shown to decrease escalation, they are not factors that target the main causes of escalation and hence, cannot be generalized to a large range of situations. The research on objective information items are more interesting since it gives a list of factors to be focused on. But this list is not enough. In none of the research, the subjects neither showed an interest in receiving these types of information nor made an effort to collect such information. Moreover, the subjects were given just one type of information. For instance, in the experiment on endogenous vs. exogenous causes of failure, the subjects were presented either endogenous causes or exogenous causes. In

reality, however, decision-makers would be confronted with both types of information simultaneously. Given the selective perception and confirmation tendencies, one can expect the decision-makers to either disregard or bias the disconfirming information. Now that a list of de-biasing information items is known it would be better to generate techniques that can focus on the main causes of escalation and aim at making the decision-makers actively and purposefully identify the information items that can generate de-escalation.

Research identifying de-escalation techniques has been scarce. And not all involved identifying techniques that can make decision-makers aware of the underlying causes of escalation. One such proposed technique is devil's advocacy (Schwenk, 1988). Devil's advocacy is used for introducing structured conflict in strategic decision-making. Schwenk proposed that devil's advocacy can help decision-makers question their assumptions and reduce escalating commitment. The results of the experimental work gave only marginal support to this proposition.

The first paper focusing on developing and comparing different procedures for de-escalation is of Simonson and Staw (1992). They proposed 6 different techniques (thorough decision making, minimum goal setting, threat reduction, self-diagnosticity, accountability for decision process, and accountability for decision outcome; see table 1). These techniques were thought to either reduce self-justification motives and/or stimulate more accurate decision making. Through experimental research, they showed that setting minimum goal setting, threat reduction, and accountability for the decision process reduced the resource allocation after negative feedback. These results indicate that vigilant decision-making does not seem to reduce escalation tendencies. Simonson and Staw indicated that it might be necessary to individuals might need to be pointed to the right elements of a decision rather than being given general instructions. The fact that accountability for decision outcomes leads to increased commitment whereas threat reduction leads to decreased commitment supports the idea that self-justification motives is a cause of escalation and reducing it can lead to de-escalation. This is also evident in the fact that accountability for decision process leads to de-escalation. If individuals are held responsible for how they make decisions rather than the performance level itself de-escalation is achieved.

Table 1: De-escalation techniques tested by Simonson and Staw (1992)

Technique	**Explanation (Simonson and Staw, 1992: 421)**	**Purpose**
Thorough decision making	"Instructing decision makers to prepare a detailed outline of the advantages and disadvantages of each action alternative prior to reaching a decision"	Stimulating more accurate decision making
Minimum goal setting	"Instructing decision makers to outline minimum target levels which id not achieved will lead to a change in policy"	
Threat reduction	"Instructing concerns about self- and external justification"	Reducing self-justification motives
Self-diagnosticity	"Informing decision makers that their decisions are reliable indicators of their abilities"	Mixed: Have potential for

Accountability for decision process	"Informing decision makers that their decisions will be evaluated on the basis of the effectiveness of their decision process"	stimulating more accurate decision making but they can heighten self-justification motives.
Accountability for decision outcome	"Informing individuals that they will be evaluated on the effectiveness of their initial investment decisions"	

Following Simonson and Staw, Bouilding et. al. (1997) devised and tested decision-making procedures that might reduce escalating commitment tendencies to failing new products. They proposed 5 procedures (highlighting uncertainty and possible negative outcomes, highlighting the opportunity costs of continued investment, pre-commitment to a predetermined stopping rule, pre-commitment to a self-specified stopping rule, decision decoupling). Based on the results on experimental work, Bouilding et. al. came up with three main conclusions. First, giving decision-makers improved information does not reduce escalation since managers distort information to justify commitment. Second, procedures such as decision decoupling and predetermined stopping rule that decrease reliance on information are most effective in generating de-escalation. And finally, if manager believe that they can control the uncertainties then tendency to escalate persists.

Overall conclusion from these papers can be that procedures that take away justification worries and that identify a stopping condition beforehand seem to lead to de-escalation. Given that justification motive is one of the main causes of commitment, taking such worries away is a just strategy. However, identifying a stopping condition beforehand hinder any diagnostic approach that the decision-maker can take during the process. Boulding et. al.'s conclusions also point out that giving improved information, on its own, does not solve the problem. If the decision-makers do not identify the information to pay attention to and its content themselves they are likely to fall prey for various information processing biases. Hence, a technique that can get the decision-makers to actively think about the problem, its causes and consequences could help avoid the biases and escalation. Such a technique will be discussed in the next section.

System dynamics as a de-escalation technique

The list of factors that lead to de-escalation includes information items such as causes of setback, availability of alternative courses of action, efficacy of resources. However, if information is given to the decision-makers the risk exists that the decision-makers will not use it appropriately. Hence, it would be useful to identify a technique that can help decision-makers identify what type of indicators to pay attention to, why a certain strategy is failing, and the consequences of re-investment and at the same time, help them identify alternative courses of action if the current action is to be abandoned.

Causal loop diagrams (CLDs) can serve this purpose well. The main advantage of a CLD is to make the variables of interest in the problematic situation and the relationships amongst them explicit. This would give the decision-makers the opportunity to formalize their hidden cognitive processes and question any existing inconsistency. Through the analysis

of this model, decision-makers can identify the variables on which further information should be collected, why the chosen strategy is failing, whether the causes are endogenous or exogenous, temporary or permanent, and what the consequences would be if the strategy is continued. Therefore, we propose that decision-makers who use a CLD while making a re-investment decision after a failure feedback will feel less committed to the strategy and invest less money in it than those who do not use any decision aid. Moreover, we propose that the strength of a causal loop diagram comes from showing the feedback relations amongst variables and hence, in decreasing commitment, a CLD is superior to a list of variables.
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Hypothesis 1a: After subjects have made the initial investment decision and received failure feedback, those given a causal loop diagram will invest less money in the second investment decision than those not given any decision aid.

Hypothesis 1b: After subjects have made the initial investment decision and received failure feedback, those given a causal loop diagram will invest less money in the second investment decision than those given a list of important factors.

Hypothesis 2a: After subjects have made the initial investment decision and received failure feedback, those given a causal loop diagram will feel less committed in the second investment decision than those not given any decision aid.

Hypothesis 2b: After subjects have made the initial investment decision and received failure feedback, those given a causal loop diagram will feel less committed in the second investment decision than those given a list of important factors.

We also propose that a list of important variables is better than having no decision aid.

Hypothesis 3: After subjects have made the initial investment decision and received failure feedback, those given a list of important factors will invest less money in the second investment decision than those not given any decision aid.

Hypothesis 4: After subjects have made the initial investment decision and received failure feedback, those given a list of important factors will feel less committed in the second investment decision than those not given any decision aid.

Method

As in much of the escalation literature, the present study involved an experiment, using business students as subjects. An experiment is useful at this stage since it enables a controlled environment in which we can attribute the effects only to the experimental manipulation.

Overall Design

The subjects were 168 undergraduate students. The experiment was part of a methodology course and participation was on a voluntary basis. Subjects were randomly assigned into one of the three conditions (a 1X3 design). In each condition, the subjects made two decisions concerning the experimental task.

Experimental Task

All the subjects were asked to work on a supermarket case developed by the first author. The case described a successful high-quality supermarket chain that was facing some problems regarding profits and market share. Hence, there was a need for a new strategy. The subjects were told that they were a long-term member of the board of directors were strongly supporting the so-called discounting strategy. After writing a short paragraph on why they thought the discounting strategy is a good strategy the subjects answered the experimental questionnaire which included questions to measure their commitment. Two types of commitment were measured: behavioral (money invested, 0 to 1 million euros) and attitudinal (5 item scale, 7-point Likert scale). Consecutively, they all received the performance feedback that stressed that the strategy was not performing well. Before they were asked to make a decision on whether to go on with the strategy or not the experimental manipulation took place. Subjects were randomly assigned to one of three experimental conditions. Following the manipulation, the subjects once again filled in the experimental questionnaire with questions to measure their commitment.

Experimental Conditions

Baseline. The baseline condition was identical to the 'committed/negative feedback' condition in previous escalation experiments. They received only the negative performance feedback and no decision aid to help with the second investment decision.

The subjects in the two experimental conditions were told that their company did research to understand the competitive environment with the purpose of gaining more insights into important factors that affect their business. Consecutively, both experimental groups were given the results of this research.

List of important factors. In this condition, alongside the negative performance feedback the subjects were presented with a list of important factors. They were told that the result of the research done "a list of important factors that the company should monitor".

Causal loop diagram. In this condition, alongside the negative performance feedback the subjects were presented with a causal loop diagram. They were told that the result of the research included "a causal model which shows the relations amongst important factors" that affect the company's business.

The information that the experimental groups received contained the typical results of two different sorts of methods organizations can use to support decision making. The list of

important factors can be a result of market research or critical success factors which are commonly used in identifying relevant types of information for decision making. The causal loop diagram, on the other hand, is a result of applying a qualitative system dynamics.

Results

Analyses were performed for the initial commitment, commitment after performance feedback, and the difference in commitment between these two measures.

Initial commitment was measured after the subjects read the case information before the performance feedback and the manipulation. There were no significant differences between the groups (see table 2 for the averages). The commitment levels were also in agreement with the subjects from previous experiments indicating that the inducement of commitment in the case description was successful.

Table 2: Mean initial investment and initial attitudinal commitment.

	N	Initial Behavioral commitment		Initial Attitudinal commitment	
		Mean	Std. Dev	Mean	Std. Dev
Baseline	38	774473.68	197082.743	5.505	1.0121
List of important factors	47	746808.51	236230.418	5.255	1.0195
Causal loop diagram	31	759677.42	254106.065	5.381	1.0849
Total	116	759310.34	227602.721	5.371	1.0314

Analysis of variance was conducted on both commitment measures to determine the effect of the two techniques on c*ommitment after negative performance feedback* (see table 3 for averages). The 1X3 analysis of variance on money invested yielded an almost significant effect for the manipulation ($F(2, 114)=2.860$, $p=0.061$). Examination of planned contrasts between the baseline and each of the conditions showed one significant and one marginally effects. As hypothesized, receiving a causal loop diagram reduced commitment below that of the baseline ($t(112) = -2.264$, $p < 0.05$). Receiving a list of factors reduced the commitment below that of the baseline but the effect was only marginally significant ($t(112) = -1.789$, $p < 0.1$). There was no difference between the two experimental groups ($t(112) = -0.695$, $p = 0.488$).

The 1X3 analysis of variance on attitudinal commitment yielded a significant effect for the manipulation ($F(2, 115)=5.484$, $p<0.01$). Examination of planned contrasts between the baseline and each of the conditions showed two significant effects. As hypothesized, receiving a causal loop diagram reduced commitment below that of the baseline ($t(113) = -3.264$, $p < 0.005$). Receiving a list of factors also reduced the commitment below that of the baseline ($t(113) = -2.110$, $p < 0.05$). There was no difference between the two experimental groups ($t(113) = -1.425$, $p = 0.157$).

The analysis results indicate that receiving both a list of important factors and a causal loop diagram as a decision aid leads to a decrease in commitment as compared to no receiving any decision aid. This gives support for hypotheses 1a, 2a, 3, and 4. Even though the list group invested and felt more committed than the CLD group, the differences were not significant. Thus, hypotheses 1b and 2b are rejected.

Table 3: Mean investment and attitudinal commitment after the negative performance feedback.

	N	Behavioral commitment		Attitudinal commitment	
		Mean	Std. Dev	Mean	Std. Dev
Baseline	38	623947.37	313709.622	4.9	1.2681
List of important factors	47	489361.70	335399.854	4.319	1.3904
Causal loop diagram	31	433333.33	393773.376	3.903	1.0236
Total	116	519217.39	350346.064	4.398	1.3099

Additional analysis was performed on the difference in commitment levels between the first (before performance feedback) and the second (before performance feedback) measures (see table 4 for averages).

For difference in money invested, analysis of variance showed a marginally significant main effect for the manipulation ($F(2,112)=2.535$, $p=0.084$). The planned contrasts indicated that receiving a causal loop diagram led to a larger decrease in investment as compared to the baseline ($t(112) = -2.175$, $p < 0.05$). There were no differences, however, between the list group and baseline or between list group and the CLD group.

For difference in attitudinal commitment, analysis of variance showed a significant main effects for the manipulation (Welsch $F(2,69.247)=6.648$, $p < 0.005$). The planned contrasts indicated that receiving a causal loop diagram led to a larger decrease in commitment more than the baseline ($t(52.756) = -3.646$, $p < 0.005$). Moreover, the subjects receiving a CLD decreased their commitment more than those who received a list of important factors ($t(67.813) = -2.023$, $p < 0.05$). There was no significant difference between the list group and the baseline ($t(80.056) = -1.511$, $p = 0.135$).

The analysis results for the difference measure gave different results for the behavioral and attitudinal commitment. Whereas for money invested, the only significant difference is between the subjects receiving a CLD and receiving no decision aid, for attitudinal commitment, CLD subjects decreased their attitudinal commitment significantly more than both the subjects receiving no decision aid and the subjects who receive a list. Hence, for the behavioral commitment, there is support for hypothesis 1a and for attitudinal commitment, for hypotheses 2a and 2b.

Table 4: Mean differences in investment and attitudinal commitment before and after performance feedback

	N	Difference in Behavioral commitment		Difference in Attitudinal commitment	
		Mean	Std. Dev	Mean	Std. Dev
Baseline	38	-150526	275356,745	-,605	,7993
List of important factors	47	-259574	323640,685	-,936	1,2102
Causal loop diagram	31	-318333	350242,117	-1,477	1,1191
Total	116	-238870	320185,706	-,972	1,1099

Conclusion and Discussion

This research examined the effect of a causal loop diagram in decreasing escalation of commitment. Overall, there is full support that CLDs can be used for generating de-escalation.

The findings from the analysis on commitment after the performance feedback clearly showed that the escalation effect was significantly decreased in subjects receiving a causal loop diagram. The results also indicate that receiving a list of important variables prior to commitment decision also leads to a decrease in commitment. Contrary to the expectations, there were no differential effects between receiving a causal loop diagram or a list of important factors. Even though the list group invested and felt more committed than the CLD group, this difference was not significant. It seems that seeing the feedback relations between the variables does not have an additional de-escalating effect. There were also no differences between the behavioral and attitudinal commitment.

One difference between the CLD and the list groups was in the decrease in attitudinal commitment. Subjects receiving a causal loop diagram decreased their commitment significantly more than all the other subjects. If the measure of escalation of commitment were the change in commitment as a result of performance feedback there would have also been support for the hypothesis that CLDs form a more power de-escalation tool than a simple list of variables.

Even though the results give support to our expectations it is not clear what aspect of a CLD led to a decrease in commitment. The way the subjects used the CLDs or whether they analyzed it appropriately was not measured and hence, was not taken into consideration. Further research should also take this aspect into account.

It should also be realized that the subjects did not build the model themselves. They received a two page document explaining the causal structure behind the problematic situation. This could explain the lack of difference between the CLD and list groups. Next step in researching the effectiveness of CLDs should be investigating whether going through a system dynamics model building session decreases escalation further. Being involved in model building would increase the contribution of the model and its results to the decision-making process of whether to keep on investing in a failing course of action. Moreover, if the decision makers and the evaluators of the results would go through a

model building process together this could decrease the justification needs of the decision makers.

Even though CLDs are very useful and important for representing the feedback structure of systems (Sterman, 2000), they can be insufficient for understanding the dynamic implications of actions. This problem gets more pressing as the model gets more and more complicated. Hence, to see the full effect of system dynamics as a de-escalation technique, analysis results from a quantitative system dynamics model should be used as a decision aid.

References

Arkes H.R. and C. Blumer. 1985. The Psychology of Sunk Cost. *Organizational Behavior and Human Decision Processes* 35: 124-140.)

Bateman T. 1986. The Escalation of Commitment in Sequential Decision-making. *Decision Sciences* 17: 33-49.

Brockner J. and J.Z. Rubin. 1985. *Entrapment in Escalating Conflicts*. New York: Springer-Verlag.

Boulding W, R. Morgan, and R. Staelin. 1997. Pulling the Plug to Stop New Product Drain. *Journal of Marketing Research* 34(1): 164-176.

Brockner J, M.C. Shaw, J.Z. Rubin. 1979. Factors Affecting Withdrawal from an Escalating Conflict: Quitting Before It's Too Late. *Journal of Experimental Social Psychology* 15: 492-503.

Garland H., C.A. Sandefur, A.C. Rogers. 1990. De-escalation of Commitment in Oil Exploration: When Sunk Costs and Negative Feedback Coincide. *Journal of Applied Psychology* 75(6): 721-727.

Keil M. 1995. Pulling the Plug: Software Project Management and the Problem of Project Escalation. *MIS Quarterly* 19(4): 421-447.

Keil M. and D. Robey, 1995. Turning Around Troubles Software Projects: An Exploratory Study of the Deescalation of Commitment to Failing Courses of Action. *Journal of Management information Systems* 15(4): 63-87.

Kernan and Lord, 1989

McCain B.E. 1986. Continuing Investment Under Conditions of Failure: A Laboratory Study of the Limits of Escalation. *Journal of Applied Psychology* 71(2): 280-284.

Montealegre R. and M. Keil. 2000. De-escalating Information Technology Projects: Lessons from the Denver international Airport. *MIS Quarterly* 24(3): 417-447.

Northcraft G.B. and M.A. Neale. 1986. Opportunity Costs and the Framing of Resource Allocation Decisions. *Organizational Behavior and Human Decision Processes* 37: 348-356.

Schwenk C. 1988. Effects of Devil's Advocacy on Escalating Commitment. *Human Relations* 41(10): 769-782.

Simonson I and B.M. Staw. 1992. Deescalation Strategies: A Comparison of Techniques for Reducing Commitment to Losing Courses of Action. *Journal of Applied Psychology* 77(4): 419-426.

Staw, B.M. 1976. Knee-deep in the big muddy: A Study of Escalating Commitment to a Chosen Course of Action. *Organizational Behavior and Human Performance* 16: 27-44.

Staw, B.M. 1981. The Escalation of Commitment to a Course of Action. *Academy of Management Review* 6: 577-587.

Staw B.M. and F.V. Fox. 1977. Escalation – The Determinants of Commitment to a Chosen Course of Action. *Human Relations* 30(5): 431-450.

Staw, B.M. and H. Hoang. 1995. Sunk costs in the NBA: Why draft order affects playing time and survival in professional basketball. *Administrative Science Quarterly* 40(2): 474-495.

Staw B.M. and J. Ross. 1978. Commitment to Policy Decisions: A Multi-Theoretical Perspective. *Administrative Science Quarterly* 23(1): 40-64.

Staw, B.M. and J. Ross. 1987. Behavior in Escalation Situations: Antecedents, Prototypes, and Solutions. In B.M. Staw and L.L. Cummings (Eds) *Research in Organizational Behavior* 9: 39-78.

Sterman, J.D. 2000. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Boston: McGraw Hill.

Tegar, A. 1980. *Too Much Invested to Quit*. New York: Perfamon Press.